

Appl. No. 09/806,401
Amdt. Dated August 20, 2004
Reply to Office Action of May 10, 2004

REMARKS

The Office Action mailed on May 10, 2004, is acknowledged. Applicants request re-examination of the above-mentioned application in view of the above amendments and the following remarks.

Rejections Under 35 U.S.C. § 103(a)

Claims 1-4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of U.S. Patent 5,861,322 to Caillat in view of U.S. Patent Application 2002/0109218 filed by Akram.

Specifically, the Examiner asserts:

At column 5, line 29 to column 6, line 43, Caillat discloses an electronic module, in particular a multichip module, comprising a multilayer wiring 104, 108, 112, 114, 118 having at least one IC component 130 applied on the component side thereof, said module being unilaterally covered on the component side with a case 134, and comprising a plurality of contact pads 138 on a bottom side of the module through for contacting and integration of the module to a next higher assembly group level, the bottom side of the multilayer wiring constituting directly, without additional wiring substrate, the bottom side of the module, the component side of the multilayer wiring adhering to the hermetic case with its portions that are free from components, said hermetic case being formed by plastics overmolding, and in that the multilayer wiring has a height of less than approximately 100 μm , wherein the multilayer wiring is constituted by a sequence of structured metal planes which are electrically separated from each other by insulating layers 104, 114 and between which purposeful electric connections are established through vias, wherein solderable material 140 is applied to the contact pads on the bottom side of the multilayer wiring, electrically connected to the component side through vias, for establishing contact with the next higher assembly group level ("printed circuit board"), wherein the solderable material is applied in the form of solder balls.

The Examiner does state that "Caillat does not appear to explicitly teach a hermetic case."

The Examiner also asserts that:

Caillat discloses an underfill case 134, and at paragraph 0004, Akram discloses a hermetic "underfill" case. Moreover, it would have been obvious to use the hermetic underfill case of Akram as the underfill case of Caillat

because, as taught by Akram, it would provide environmental protection and enhance the attachment of the component to the wiring.

In addition, the Examiner also asserts:

it would have been obvious to substitute or combine the underfill case of Akram for or with the underfill case of Caillat because it would provide an underfill case, and use/substitution of a known element based on its suitability for its intended use has been held to be prima facie obvious. Also, it would have been obvious to substitute the underfill case of Akram for the underfill case of Caillat because it would provide an underfill case when the use of the underfill case of Caillat becomes infeasible, e.g., when the underfill case of Caillat is cost ineffective or when it is unavailable due to a supply disruption.

The Applicants respectfully disagree.

The Teachings of Caillat

Caillat teaches to rigidly connect the chip 130 with the interconnection substrate 101 by an underfill encapsulate (column 6, lines 19-21, fig. 10). There is no indication of any further purpose of the underfill 134 as taught in Caillat. Furthermore, Caillat actually teaches a separate cover 136 that functions to protect both the chip 130 and the underfill 134 (column 6, lines 19-21; Figs. 9-11).

The Teachings of Akram

Akram indicates in ¶ [0004] that using only an underfill encapsulate causes problems and can lead to catastrophic failure of the chip. In fact, Akram teaches arranging on the semiconductor chip back surface a protective plate and a glob top encapsulant enclosing the underfill material and embedding the circumferential edges of the protective plate.

Akram not only requires the application of three different materials (underfill, protective plate, glob top) but leaves unprotected those surface portions of the wiring substrate which are free from semiconductor chips.

The Present Invention

In the present invention, the component side of the electronic module is covered by a hermetic case produced in a single overmolding step thereby simplifying the

manufacturing of the electronic module in comparison to both Caillat and Akram. In Caillat, the manufacture of the module requires two steps to achieve the hermetic case of the present invention: 1) the application of the underfill; and 2) the addition of the cover. Moreover, Akram needs three steps to achieve the same: 1) application of the underfill; 2) addition of a protective plate; and 3) addition of a glob top. Accordingly, the manufacture of the present invention may be accomplished substantially cheaper and easier than either of the modules described in either Caillat or Akram.

In addition, the hermetic case of the present invention provides technological advantages over either Caillat or Akram. The hermetic case adheres to the component sides of the multilayer wiring that are free from components. Accordingly, there need be no concern relating to varying rates of thermal expansion between the over-molded hermetic case on the one hand and the elements of the IC-chips on the other. In both Caillat and Akram, wherein an underfill encapsulant is utilized, ambient temperature changes would rip loose the wire bonds from the chips. Furthermore, the hermetic case of the present invention also provides protection of the component side of the electronic module since the hermetic case is free from other components.

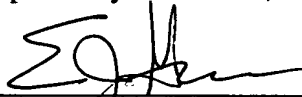
As a result, the hermetic case of the present invention protects the entire component side of the multilayer wiring including those portions that are free from components with full relief with regard to the problems related to mismatching of coefficients of the thermal expansion.

The combination of Caillat and Akram do not teach the present invention. Caillat teaches the utilization of two covering elements (the underfill and the cover) to protect the chip. Similarly, Akram teaches the utilization of three covering elements (the underfill, protective plate, and glob top) to protect the chips. Combining these two references does not render obvious the present invention in which a single covering element (overmolded hermetic case) covers the chip, as taught by the present invention. In particular, neither Caillat nor Akram nor both in combination can give any suggestion to adhere the hermetic case to the layers of multilayer wiring that are free from components avoiding problems with respect to thermal expansion.

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If necessary to effect a timely response, please consider this paper a request for an extension of time, and charge any shortages in fees, or apply any overpayment credits, to Baker & Daniels' Deposit Account No. 02-0387 (72262.70012). However, please do not include the payment of issue fees.

Respectfully submitted,

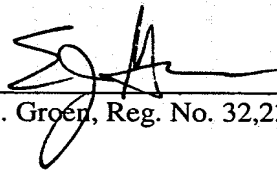


Eric J. Groen, Reg. No. 32,230
BAKER & DANIELS
205 West Jefferson Boulevard, Suite 250
South Bend, IN 46601
Telephone: (574) 234-4149
Fax: (574)239-1900

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August 20, 2004

Date



Eric J. Groen, Reg. No. 32,230